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HYBRIDS OF THE GENUS EPILOBIUM

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THAT hybridism and sterility are closely related has been long recognized in a general way, but it is only within the last few years that a systematic and comprehensive investigation, at least of the plant kingdom, has been attempted. Professor Jeffrey and his students,[1] working on the flora of eastern North America, have

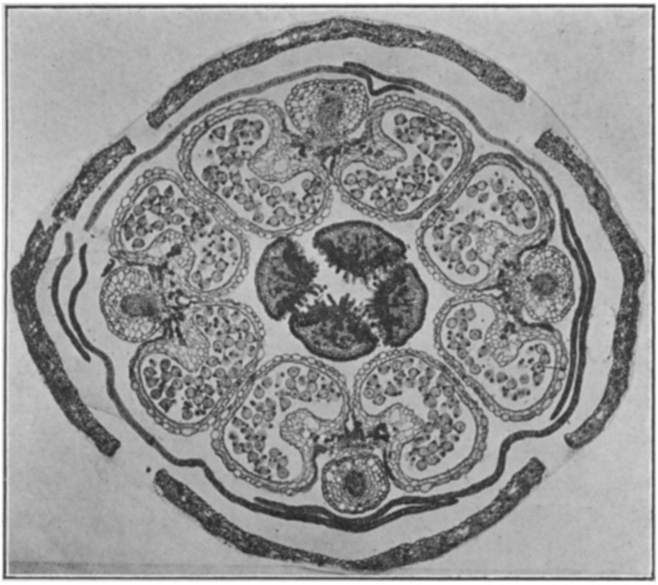

FIG. 1. Flower of *Chamænerion angustifolium*, Southern Ontario.

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[1] Jeffrey, E. C., "The Mutation Myth," *Science*, N. S., 39: 488–491, 1914; "Spore Conditions in Hybrids and the Mutation Hypothesis of De Vries," *Bot. Gaz.*, Vol. LVIII, No. 4, Oct., 1914; "Some Fundamental Morphological Objections to the Mutation Theory of De Vries," AMER. NAT., 1915; Holden, R., "Anatomy as a Means of Diagnosis of Spontaneous Plant Hybrids," *Science*, N. S., 38: 932–933, 1913; "Anatomy of a Hybrid Equisetum," *Amer. Jour. cf Bot.*, May, 1915.

demonstrated that the infertility of hybrids is due to the abnormal development of the gametic elements, particularly the pollen grains, and have shown that whenever the purity of a species is unquestionable, the spores are uniform, in both size and shape, while, conversely, the spores of hybrids are usually irregular, some appearing normal and others being shrunken and devoid of protoplasm. During the past year the writer has extended these investigations to include a considerable number of English species. Many interesting cases have been encountered, which will be elucidated in detail on another occasion, but the conditions in the genus *Epilobium* are so diagrammatic and typical, that it seems advisable to describe them now.

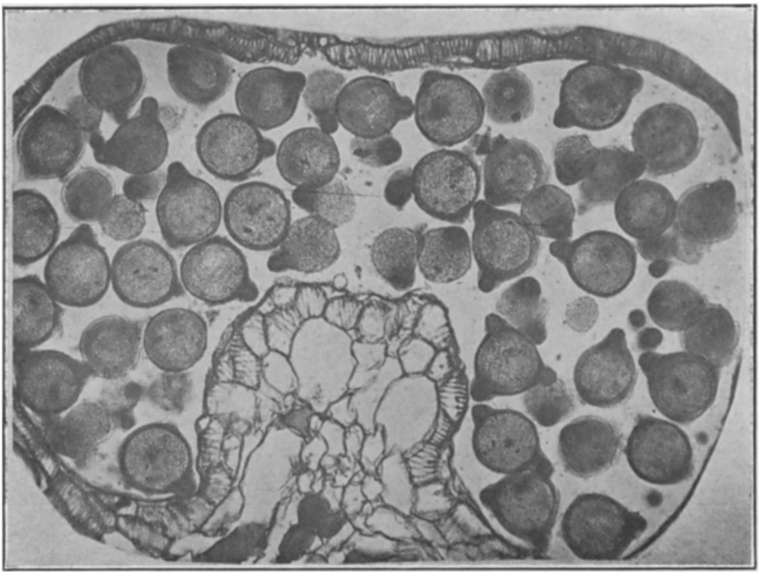

FIG. 2. Half of Anther of *C. angustifolium*, Southern Ontario.

This genus is divided into two sections, *Chamænerion* and *Epilobium* proper, the chief differences being that in the former the flowers are irregular and the spores not in tetrads, while in the latter the flowers are regular and the spores are persistent as tetrads. Both in eastern

North America and in England, the former section is represented only by *E. angustifolium* (L.), while the latter includes numerous species. Moreover, although the species of the *Epilobium* section are generally recognized to hybridize freely with one another, they do not hybridize with the *Chamænerion* section. Accordingly, one would expect to find only good pollen in the anthers of *E. angustifolium,* and a mixture of good and bad in all the others. Investigation of the North American forms showed that such was indeed the case, and photomicrographs illustrating these conditions were published.[2] When the writer came to examine English specimens, however, a different state of affairs was discovered. Abortive spores were found not only in *E. montanum, E. parviflorum* and *E. hirsutum,* as might have been anticipated, but also in *E. angustifolium. E. angustifolium* grows wild in only two localities in the vicinity of Cambridge, Hardwick and Gamlingay, but in specimens from

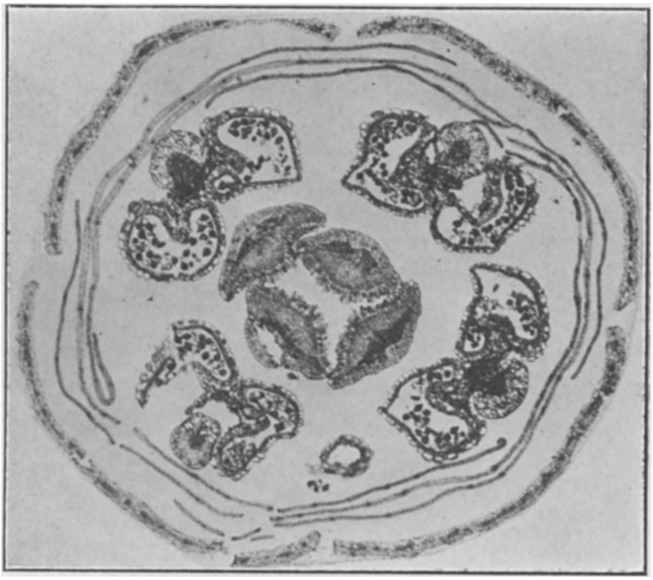

FIG. 3. Flower of *Chamænerion angustifolium* (Hardwick, England). Showing shrivelled anther.

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[2] *Loc. cit.*

both these places, as well as in others from the botanical gardens of Cambridge University, the same mixture of good and bad grains was found. These facts seemed to invalidate the conclusion that abortive spores are an invariable sign of hybridism, but, as has so often been the case in scientific matters, evidence which at first seems to discredit a given hypothesis, on further investigation is seen actually to corroborate that same hypothesis.

Reference to systematic works shows that there are two varieties of *E. angustifolium* growing in England, *E. macrocarpum* (Steph.) and *E. brachycarpum* (Leight). There are a number of minor differences in the length of the stolons, shape of the leaves, flowers, etc., but the most definite is the relative length of capsule and pedicel. *E. macrocarpum*[3] grows sparingly but generally from Somerset and Hants. to Orkney, while *E. brachycarpum,* though cultivated commonly all over England, is found much more rarely in the wild condition, being recorded

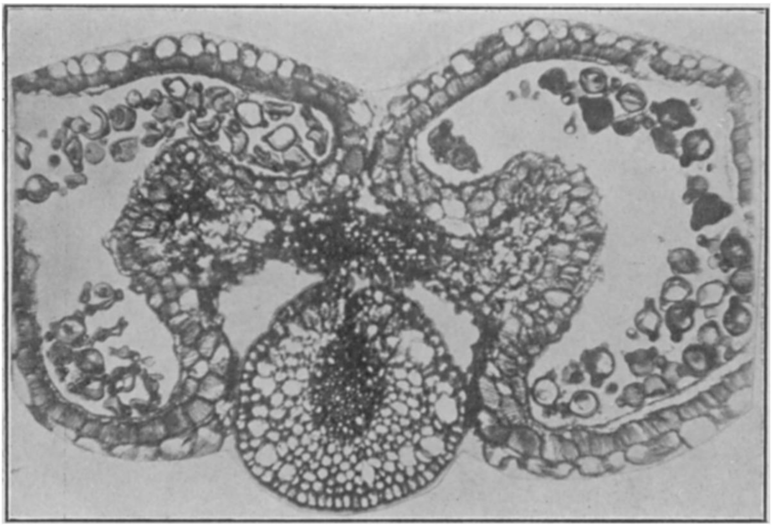

FIG. 4. Transverse section of *Chamænerion angustifolium,* showing abortive pollen. (Hardwick, England.)

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[3] Boswell, Syme, "English Botany."

from Shropshire, N. Wales, Yorkshire, and even near Edinburgh. Through the kindness of Dr. Wilmott the writer was able to examine the spores of a considerable number of both these varieties from specimens in the herbarium of the British Museum, and in every case the anthers contained a mixture of normal and abortive grains.

We have here, then, a very interesting condition—wherever the two varieties of *E. angustifolium* are present, the spores are partially abortive—indicating the bar sinister; this state of affairs is found in England, and probably in Europe, Asia and western North America, where both varieties are known to coexist. Wherever, on the other hand, as in southeastern North America, there is but one variety, the spores are all normal. *Chamænerion,* therefore, instead of discrediting the value of abortive pollen grains as a test for hybridism, affords another instance of its value. It also suggests another question—how far apart genetically must individuals be before the spores begin to degenerate? Hitherto it has been assumed that only crosses between recognized species bring about that result, but in the case of *Epilobium,* the varietal difference appears sufficient. This, however, opens up the whole question of what is a species, and can not be entered upon here.